GUJARAT NARMADA VALLEY FERTILIZERS & CHEMICALS LIMITED

TECHNICAL SPECIFICATION FOR INDUSTRIAL PAINTING WORK at TDI-II DAHEJ

Part - 1 :- Technical specification for industrial paint materials

1) Paint materials to be provided & utilized for the work shall be adhering to following composition/ specification& volume solid requirement.

1.1	Chromate-free Red oxide Zinc Phosphate primer paint Composition: %NVM by volume Solid : Min 40 % Zinc Phosphate : percent by mass on pigment, Min. 16% Red Oxide as Fe2O3 of Iron : percent by mass on pigment, Min. 50% Pigment content, percent by mass : 50± 5% Colour Shade : Red
1.2	First Quality Synthetic enamel paint Composition : Alkyd Resin %NVM by volume Solid : Min 30 % Colour Shade : French Blue / Sea green / Fire Red / Sky Blue / Cannary Yellow/ Deep Orange/ Light Grey/ White / Balck / Dark Grey / Brown etc.
1.3	Self Priming HB Epoxy : Resin (Base) : Epoxy Resin (Hardener) : Polyamide %NVM by Volume : Min 75 % Viscosity by Ford cup @ 30 deg. C : Thick Colour Shade : Silver grey / Light grey/ etc.
1.4	Solvent less Epoxy : Epoxy Equivalent Weight (range) : 180-200 %NVM by Volume (Min) : Min 85 % Viscosity by Ford cup @ 30 °C: Thick Colour Shade : Light Grey / Drak Grey / etc.
1.5	Acrylic Aliphatic PU Paint : Type of Isocynate : Aliphatic Isocynate Resin (Base) : Acrylic PU Resin (Hardener) : Isocynate %NVM by Volume : Min 40 %

	Viscosity by Ford cup @ 30 deg. C : Thick Pencil Hardness : 2H Colour Shade : French Blue / Sea green / Fire Red / Sky Blue / Cannary Yellow/ Deep Orange/ Light Grey/ White / Black / Dark Grey / Brown/ etc.
1.6	Acrylic Aliphatic PU HIGH BUILD Paint: Type of Isocynate : Aliphatic Isocynate Resin (Base) : Acrylic PU Resin (Hardener) : Isocynate %NVM by Volume : Min 55 % Viscosity by Ford cup @ 30 deg. C : Thick Pencil Hardness : 2H Colour Shade : French Blue / Sea green / Fire Red / Sky Blue / Cannary Yellow/ Deep Orange/ Light Grey/ White / Black / Dark Grey / Brown/ etc.
1.7	Epoxy HB MIO: Epoxy Equivalent Weight (range) : 400-500 Resin (Base) : Epoxy Resin (Hardener) : Polyamide %NVM by Volume (Min) : Min 55 % Viscosity by Ford cup @ 30 deg. C : Thick Colour Shade : Brown
1.8	HR paint –Temperature Resistance Up to 250 deg c Specification as per following composition :Silicon Resin and aluminum Heat Resistance / 2hr : to pass the test % NVM by Volume (Min) : Min 25%
1.9	HR paint – Temperature Resistance 250 to 400 deg c Specification as per following composition : Silicon Resin and aluminum Heat Resistance / 2hr : to pass the test %NVM by Volume (Min) : Min 25 %
1.10	HR paint – Temperature Resistance 400 to 600 deg c Specification as per following composition :Silicon Resin and aluminum Heat Resistance / 2hr : to pass the test %NVM by Volume (Min) : Min 25 %

1.11	General purpose thinner with mineral turpentine oil base compatible for alkyd paint, red oxide zinc chromate primer
1.12	Thinner for Epoxy Paint : Compatible thinner for epoxy paint like self priming high build epoxy paint, solventless epoxy paint, epoxy MIO
1.13	Thinner for PU Paint : Compatible thinner for acrylic aliphatic polyurethane paint

1.14 Following additional tests to be carried out at manufacturing works for paint materials as per need.

i) Salt Spray Test : As per ASTM B 117 :

- Requirement for Self-Priming HB Epoxy and solvent less Epoxy paint : No sign of corrosion and no sign of deterioration upto1000 hours of exposure

- Requirement for Polyurethane paint : No sign of corrosion and no sign of deterioration upto500 hours of exposure

ii) Humidity Test : As per ASTM D 2247:

- Requirement for Self-Priming HB Epoxy and solvent less Epoxy paint : No sign of corrosion and no sign of deterioration upto1000 hours of exposure

- Requirement for Polyurethane paint : No sign of corrosion and no sign of deterioration upto500 hours of exposure

iii) QUV Accelerated weathering Test :

a) Gloss change or gloss retention (ASTM D523)

b) Colour Change (ΔE) (ASTM D 2244)

c) Chalking Resistance (ASTM D 4214)

- Requirement for Polyurethane paint : 90% gloss retention/ color retention and no chalking after 1000 hours of exposure. (ASTM G 154)

iv) IR Spectroscopy Test.

2) Paint Materials shall be used before its performance life/ shelf life is over. It must have 9 months shelf life.

3) Storage of Paint materials shall be as specified by the manufacturer

4) Paint supply from the manufacture is to be staggered based on site requirement.

5) Batch test certificates for paint quality, technical datasheet & MSDS are to be obtained from the paint supplier for each supply of materials. The same shall be given to GNFC on supply of paints.

6) Along with the supply of each lot, the contractor shall provide original challan of supply from manufacturer.

7) Acceptance criteria for paint materials & thinner supplied at GNFC are as under:

- Minimum residual shelf life of paint materials at the time of supply shall be 9 months
- Packing of paint & thinner drums are sealed & intact.
- Drums shall have proper labeling as specified
- Materials shall confirm to specification given at clause no. 1. 0 given above. GNFC shall carry out random testing of paint materials at GNFC laboratory and /or at Government approved outside laboratory. Result of this testing shall be final & binding to the paint manufacturer. Acceptance of quality of paint materials at the time of supply shall be based on this testing.
- All supplied materials shall be used only after acceptance & clearance by GNFC.
- **Paint material shall be inspected by GNFC and/or NACE level II inspection engineer prior to dispatch at the manufacturer's factory.**
- The manufacturing batch number must be clearly visible on the sealed tins. The batch certificate to be submitted to GNFC prior to dispatch of the paint. Batch test of analysis must be carried out in presence of representative of GNFC.
- GNFC representative will make seal & permanent marking/signature on each tins at manufacturer's works prior to dispatch after inspection. Only the duly signed tins will be accepted at site.
- NACE engineers will be assigned third party inspection work and will provide confirmation / non-confirmation report as per GNFC's requirement and at no extra cost to GNFC.
- All site tests including Dolly test will be carried out at site.
- If OEM do not have test facilities (1.14 above); the test shall be carried out at ERDA/ other place as decided by GNFC at the cost of contractor.

8) Services to be obtained from paint supplier:

During application of the paint materials the contractor shall arrange for visit of NACE level – II inspection engineer / coating inspector/s of paint manufacturer at no extra cost to GNFC, if asked by GNFC.

9) All paint materials shall be procured from GNFC's approved paint manufacturers. List of these approved paint manufacturer is as under:

9.1 M/s Asian Paints
9.2 M/s Berger Paints
9.3 M/s Johnsons & Nicholson
9.4 M/s Akzo Noble
9.5 M/s Kansai Nerolac
9.6 M/s Grower & Weil (India) Ltd.
9.7 M/s Advance Paint Pvt Ltd.
9.8 M/s Ramdev Resins Pvt Ltd.
9.9 M/s VCM Polyurethanes Pvt. Ltd.
9.10 M/s Shalimar Paints Ltd.

9.11 M/s Carboline (india) Pvt Ltd.
9.12 M/s Grand Polycoats Company Pvt. Ltd.
9.13 M/s Dooall Corpo India Pvt. Ltd.
9.14 M/s PULSE EXIM PVT. LTD, (SDPR Group)
9.15 M/s Flosil-BET Coatings (India) Pvt. Ltd,
9.16 M/s Atul Ltd.

All paint materials of one paint system to be procured from one manufacturer for each paint system.

In case of small quantum (less than or equal to 40 ltr) of paint materials, the same may be procured from authorized dealer of any of above paint manufacturers, with prior permission from GNFC.

10) Compatible thinner for each type of paint material shall be supplied by the contractor. The same shall be used for paint thinning work as per manufacturers' specification. Thinner for epoxy material, thinner for PU paint and thinner for synthetic enamel paint shall be different and shall be compatible for each type of paint.

11) Check for consumption of paint materials:

- Actual consumption of each paint materials shall be equal to or more than theoretical consumption.
- Theoretical consumption of paint material shall be work out with following formula

  Theoretical consumption in Ltr/M2 = DFT (in micron) **/** (Volume solid x 10)

- The contractor shall prepare and submit the details of paint material received at site as per GNFC's format along with inward stamp. The same will be verified by GNFC engineer at site for acceptance.

Part-2: Technical specification for application of industrial painting

(1) Scope:

This specification applies to the application of paint system (corrosion protection) of steel structures. It contains generally applicable requirements for surface preparation and application of coating materials. Paint materials with thinner shall be provided by contractor.

(2) General Requirements:

The surface to be coated shall meet the requirements specified in the detailed item description. Persons employed with coating work shall not walk or stand on insulated items of equipment, pipes with small nominal diameters, cable racks and the like.

The contactor shall sufficiently secure his working area (e.g. by cordoning off) and shall mark freshly coated equipment (e.g. by warning plates).

The contractor shall have proper arrangement for storage of coating materials and solvents. The instructions of the manufacturers of the coating material for transport and storage shall be observed as well. The applicable statutory rules for the storage of inflammable liquids (e.g. thinners) shall be followed. The storage area shall be properly ventilated.

(3) DFT per coat:

The contractor shall ensure average DFT per coat as under.

Paint Material	Minimum DFT per coat (in Micron)
Chromate-free Red oxide Zinc Phosphate primer	30
Synthetic enamel paint	25
Self-Priming HB Epoxy	80
Solvent less Epoxy	100
Acrylic Aliphatic PU Paint	30
Acrylic Aliphatic PU HIGH BUILD Paint	50
Epoxy HB MIO (Micaceous Iron Oxide)	100
HR paint – Temperature Resistance Up to 250 deg c	15
HR paint – Temperature Resistance 250 to 400 deg c	15
HR paint – Temperature Resistance 400 to 600 deg c	20

(4) Surface preparation:

The surfaces to be coated shall be free of any contamination (e.g. welding slag, welding splatter, dust, oil, grease, salt, mill scale, laitance, rust, old loose coatings).

Prior to any further surface preparation oil, grease, drilling and cutting emulsions and preservation agents shall be carefully removed from the surface by use of suitable solvents. The surfaces shall be dried very carefully with clean clothes to prevent the dissolved impurities from spreading on the entire surface.

Surface preparation and cleaning shall be done **(as per item description / scope of work)** with

- Mechanical means (using power wire brushes, power impact tools, power sanders, power grinders or combination of these tools) and manual cleaning
- Where specifically asked, surface cleaning by sand/ copper slag blasting to Sa21/2 grade shall be carried out under separate item

The loose/ rusted old coating, shop coat of primer shall be removed thoroughly from the surface. well hardened existing paint film need not be removed.

In the case of areas having sticking urea particles, the surface should be cleaned with high pressure water jet wherever and dried so that any sticking urea particle may be dissolved/removed.

The prepared surface shall be finally free from oil, grease, loose scale, salt, loose paint film and shall be dry. The prepared surface shall meet to ISO St2 standard.

(5) Application of the coating materials:

a) General Requirements:

Surface to be coated shall be completely dry and free of any contamination. Since defect of the coating (e.g. blisters and pores, inclusion of thinners, boiling of thinners, slow curing, change of over coating intervals) may occur depending on the surface temperature, the temperature range recommended by the manufacturer of the coating material shall be observed. The temperature shall also be in the specified range during hardening / curing and until the coating materials are ready to be coated over.
Two component-coating materials shall be mixed with special care so as to ensure uniform mixing.

Coating work shall be interrupted when corrosive gases or dust like substances are encountered or in the case of fog, strong wind, sudden rain or snow. Before recommencing the work, a check has to be made as to whether the coating already applied has been damaged. Damaged surfaces shall be repaired.

The coating materials shall be applied with a uniform thickness and shall properly cover the entire surface. Corners, edges, rivet and bolt heads, etc., which are not easily accessible shall be pre-coated with small brushes. Thinners shall be used only if this is specified or recommended by GNFC / manufacturer of the coating materials. Adding of thinners in excess of the specified or recommended amount is not permitted.

Depending on the coating material, a dry film thickness of upto 125 microns may be applied with brushers.

Movable components of machinery, name plates, designation plates, stems of shut-off and control valves, sight glasses, and other items not to be coated shall be carefully covered and, if required, the coating materials shall be removed from such items.

b) Primer coat.

Surfaces cleaned according to the specification of the item shall receive the prime coat immediately. Surfaces on which, rust film has formed before application of primer shall be treated again by the specified cleaning.

c) Following coats

The interval between coating and the time required for hardening/curing, which are specified by the manufacturer of the coating material, shall be observed.

(6) Checking the coating work:

The surface preparation and coating work shall be checked regularly according to the technical specification.

a) Surface preparation :

Cleaned steel surfaces should be checked properly. Surfaces may be checked with adhesive tape for cleanliness because any dirt or dust on the surface will be picked up by such a tape. Mill scale not removed can be detected by visual checking.

b) Visual check:

Prior to measuring the dry film thickness, a visual check of the coating shall be performed. The visual check shall be limited to the detection of defects due to improper coating (e.g. areas left uncoated, inclusions of dirt, blisters, porosity, sags, tears, brush marks).

c) Wet film thickness :

The wet film thickness shall be measured with a comb-type gauge within a few seconds after applying the coating materials. Comb-type gauges shall be selected in relation to the wet film thickness. The comb-type gauge shall be firmly pressed into the wet coat at a right angle to the coated surface. The gauge teeth shall be cleaned using thinner / solvent after the test.

d) Dry film thickness :

The dry film thickness shall be measured after adequate hardening/curing of the coating. To minimize the deviation from the specified total film thickness, the thickness of each individual coat should be measured.

The measurement should be performed by means of a permanent magnetic test set (e.g. Mikrotest, Elcometer) or an electromagnetic test set (e.g. Diameter SM – Ix). The test sets shall be calibrated according to the manufacturer's instructions, and checked for proper function regularly.

The mean shall not be lower than the specified total film thickness. However, individual coats may be slightly thinner than specified.

e) Degree of hardening:

The degree of hardening of two component coating materials, zinc silicates and epoxy and polyurethane coating shall be determined with the aid of solvents (e.g. methyl ethyl ketone). When a piece of cloth saturated with the solvent is rubbed over the coating, the coating must not become soft and the colour must not change.
The proper solvent and details of the test procedure shall be agreed upon by the contractor, Engineer-in-charge and the manufacturer of the coating material in due time.

f) Colour of top coat :

The colour of the topcoat shall be checked by comparison with a colour chart. Slight deviations of the colour of topcoat from the colour chart are permissible.

Stage wise inspection and supervision shall be carried out by GNFC's site engineer /supervisor. Format of stage wise clearance certificate is placed with this specification. A

representative of paint supplier will also inspect & check surface preparation & application work. GNFC will also arrange for periodic third party inspection through a NACE certified coating inspector. Recommendation of paint supplier & third party inspection shall be followed by the paint applicator.

(7) Rectification of Defects:

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of the EIC before proceeding further. The Contractor shall be responsible for making good the defects found during final inspection and during defect liability period.

(8) Safety regulations:

When handling coating materials and solvents the specified measures for the prevention of fire and sudden deflagration, the statutory safety regulations, and the instructions of the manufacturer of the coating material shall be observed.

Special care is necessary when the coating materials are transferred and stirred. Heat, open fire and sparks must be avoided at all events in the immediate surroundings.

Solvents used must not be detrimental to health. When aromatic compounds are used, adequate ventilation shall be ensured. Surfaces located in hazardous areas where inflammable substances or vapours may form shall be cleaned with the aid of non-sparking tools.

For coating work to be performed during plant operation, work permit shall be obtained prior to commencement. The work permit shall be got renewed every shift of working

The hand wheels of valves, machinery, etc. shall not be actuated. If this happens unintentionally, the Engineer-in-charge shall be informed immediately.

All safety equipments required for execution of jobs shall be used. Personal protective equipment (PPEs) like safety helmets, safety shoes, shall be provided by contractor.

Other PPEs like escape masks, safety belts, safety goggles, safety gloves PVC suits etc. shall be provided by GNFC on returnable basis. Only steel pipe scaffolding shall be used for the work. GNFC will provide safety net wherever required. The same are to fixed temporarily by the contractor for painting work of roof trusses etc.

(9) Colour Coding :

(A) For steel structure and CS equipments

Each coat shall have different colour shade as per GNFC requirement. Before ordering/ procurement of paint materials, the contractor shall obtain coat wise colour code system from GNFC.

(B) For Piping :

Colour code for piping shall be followed as per IS : 2379:1990 .Bands, Flow direction marking, hazard marking as specified in IS: 2379 shall be superimposed on the ground colour, at no extra cost to GNFC.

(10) Disposal of Waste Materials:

Hardened paint, Loose paint scale, Rust, unhardened paint, thinner, paint drums, paint barrels, etc. shall be disposed of as per GNFC's waste disposal procedure. Empty paint drums are to be taken out by the contractor. It will be the responsibility of the contractor for their proper disposal/ end use.

(11) Measurement of Works:

- Quantities for painting of piping shall be measured in terms of Sq.M referred to the actual dimensions of area painted. Area shall be computed to an accuracy of 0.01 Sq.M.
- The length of individual sections shall be measured and area shall be computed by multiplying with unit area of the section painted. For uneven surfaces, equivalent plain areas shall be considered as per IS 1200 (Part – 15)
- In case of MS grating, multiplying factor shall be 2.5 (i.e. 2.5 x plan area on one side).
- For valves, equivalent straight pipe length of 1 mtr. shall be added in total pipe length.
- No increase in area due to welding, bolts, nuts, washers, flanges shall be paid for.
- Letter writing, arrow marks, figures, hazard markings, etc. on painted surface shall not be paid for separately. These works shall be included in the unit rates of painting work.

(12) Paint Storage and Application

- Paints, Catalysts and thinners shall be stored in well ventilated buildings/store free from excessive heat, sparks, flames and direct sunlight. Paints stored for short times on the jobsite shall be protected from direct sunlight during the summer season.
- Consumption of paint material shall be on first in first out from the store. Paint material shall be consumed before expiry of shelf life.
- Painting / Coating shall be applied in strict accordance with the coating manufacturer's latest published instructions. In particular, the manufacturer's recommended curing or drying time shall be allowed between coats of primer and finish. Thickness of the coating shall be in accordance with the item specification.
- Two component (base and hardener) coatings like Air drying Epoxy, Polyurethane coatings etc shall be mixed in the ratio recommended by manufacturer to ensure proper and complete curing of the coatings. Improper ratio leads to problems like soft / non-dried film, poor performance, etc**.** The base and hardener are to be separately mixed first to obtain a homogenous mixture. The hardener is to be added to the base slowly, with continuous mixing / agitation and not the reverse. Power agitation is preferred over hand mixing. Before application, Paint / Coating inspector will oversee the operation to ensure the adherence to paint manufacturer's instructions. Only thinners of the type and quality specified shall be used. Care must be taken to mix two pack materials components according to manufacturer's recommendations.

- Paints containing heavy or metallic pigments that have a tendency to settle shall be kept in suspension by continuous use of a mechanical agitator whilst being applied, to ensure uniformity over the surface area, (e.g. zinc, MIO's pigmented materials).
- Dwelling time of two-pack components, once mixed, shall be no more than 30 minutes to enable the material to settle, and air bubbles to escape.
- During application and whilst in a set state, the surface areas shall be inspected to find holidays, runs, sags etc. Holidays will be coated in at this stage if detected prior to full drying taking place. Care must be taken to ensure contact areas, if any, are included in these criteria. Runs and sags will be brushed out.
- Once dry, visual inspection will be carried out to establish any faults present. DFT (Dry Film Thickness) will be taken and recorded. Any faults found will be rectified prior to application of the successive coatings.
- Prior to over coating, any previously applied coating, the DFT shall be taken and the surface shall be inspected for pinholes, runs, sags etc. If any defects are found and remedial action to be taken.
- All edges, corners, webs and inaccessible areas, shall be stripe coated prior to full application, to ensure integrity of WFT/DFT over surface areas.
- All coatings shall be permitted to dry in accordance with their manufacturers recommendations prior to being over coated. Attention to be given to drying temperatures, etc.
- Field application shall be by brush, roller or spray gun. Local regulations regarding spray and roller coating shall be observed. A smooth uniform film shall be applied to the surfaces to be coated. For Field joint coating where blast cleaning is not possible, minimum ST2 surface preparation to be achieved. The field paint shall be compatible to ST2 surface finish as well as to existing paint at the adjoining area.
- The temperature of the substrate must be a minimum of 3°C above the dew point during abrasive blast cleaning and coating. The substrate temperature shall be a minimum of 5°C and a maximum of 60°C during coating application.
- Containers of paint, catalysts and thinners shall not be opened prior to use except for spot inspection. They shall be tightly resealed after inspection.
- The life time of any protective system is determined by the dry film thickness of the paint system present on weld seams and sharp edges. Special attention should be given to sharp edges to ensure that they are covered with an adequate coating thickness.
- Any addition of thinner to achieve the application viscosity should be made only after the components are thoroughly mixed**.** Avoid using excess thinner than the recommended volumes, since this will lead to lower DFT build up, sagging, longer curing time, etc.
- Painting should not be undertaken during fog or mist conditions or when rain is about to happen, when the surface to be painted is wet with condensation or when condensation can occur during the initial drying period of the paint.

(13) Inspection and Testing:

- Inspection will be performed by experienced person as approved by GNFC. GNFC will arrange NACE level-II approved inspectors for inspection of work done which will be acceptable to the contractor.
- Inspection will be also carried out by representative of paint supplier. His clearance will be required as and when inspected.

- Primer coats shall be inspected and cleaned when required by GNFC, before applying second / finish coats.
- Dry film thickness shall be measured after each coat by GNFC Inspector using a Mikrotest, Elcometer, or GNFC accepted equal, Thickness testing Instrument.
- Dry thickness measurements shall be made in accordance with ISO 2808 or SSPC-PA Measurements of Dry Paint Thickness with Magnetic Gauges.
- The average value of thickness readings taken over any square meter of a scheduled area should be equal or exceed the nominal thickness specified and in no case should any reading be less than 75% of the nominal thickness.
- Areas where coating thickness both thin and too thick locations are to be marked and the Paint contractor shall carry-out repair at such areas. The surface areas shall be inspected to find holidays, runs, sags etc. Holidays, if detected shall be coated before full drying taking place. Runs and sags will be brushed out.
- Determination of the thickness of each coat in a multi-coat system should be an inspection hold-point. When using magnetic gages to measure multi-coat systems, the average of the first coat must be determined prior to application of second coat. Readings taken after the second coat is applied will obviously be the total thickness of the two coats combined, and the specific thickness of the second coat can only be determined by subtracting the average thickness obtained from the first coat reading.
- Holiday or spark testing shall be done for immersion service to find nicks, scrapes, and pin holes in the coating film. Holiday testing shall be done after application of the last coat of paint
- After all the coats of paint have been applied, the inspector should verify that the appropriate clean-up is done, and that any abrasions, nicks, or scrapes are repaired as required. If the coating is within the specification the item will be offered to the client or representative inspector where required.
- Occasionally, there is a need to test the adhesion of the coatings after application. "Measuring adhesion by Tape Test" as described in ASTM D - 3359 shall be used for adhesion test.
- Surface preparation and coating shall be documented using the Industrial painting stage wise clearance Form.

14) Tools, equipments, instruments to be supplied by the Application Contractor:

- Paint brushes
- Scrapers
- Power tools for cleaning
- Wire brushes
- Copper wire brushes for explosive area
- Stirrers
- Elcometer
- Adhesion test materials
- Viscosity cup
- Steel scaffolding materials
- Safety helmets and shoes,

***** PPE's like escape masks and safety goggle, shall be provided by GNFC.**

(15) Performance Guarantee/ Defect liability period for Painting work:

- Painting work carried out under this contract shall have performance guarantee/ defect liability period **of 12 months** from date of completion of the total work.
- In case of failure of the paint system due to quality of paint materials and/ or application during the performance guarantee period/ defect liability period, the contractor shall arrange for repainting of the area having paint failure at no extra cost to GNFC. For this, the vendor shall supply required paint materials and shall arrange for repainting of the affected area (after removal of failed painted system and proper surface preparation) at their own cost. Decision of GNFC for painting work failure shall be final binding upon the contractor.
- The contractor shall not liable for performance guarantee on following cases:
  - Loss or damage to coating arising from external causes including cutting, mechanical damage, improper use by plant, leakage/spillage/overflow of chemical on the surface, excessive exposure to corrosive gases/fumes, exposure to excess heat/steam/condensate, damage direct or indirect resulting from explosion, any other accidents, act of God.
  - Deterioration of any part of the coating system caused by any work carried out by the GNFC or by their representative/other contractors after commencement of the guarantee period.
  - Fading of paint shade/ luster.